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Article

Treading Old Paths in New Ways: Upper Secondary Students Using a Digital Tool of the Professional Historian

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Abstract: This article presents problems and possibilities associated with incorporating into history teaching a digital demographic database made for professional historians. We detect and discuss the outcome of how students in Swedish upper secondary schools respond to a teaching approach involving digitized registers comprising 19th century individuals and populations. Even though our results demonstrate that students experience the use of this digital database as messy, stressful, complicated, even meaningless and frustrating, they also perceive working with it as most interesting. We discuss this twofold outcome, its reasons and lessons to learn from it. When technology is functioning and the task is specialized and sufficiently guided by the teacher, which is not always the case, our results propose that digital databases can stimulate young people's interest and historical thinking. Knowledge construction based upon historical thinking is evident in the students' examination papers in which they present and debate their findings. These papers indicate that students can use a digital database and write history based upon empirical evidence, source criticism and historical empathy, just as professional historians do.

Keywords: digital databases; history teaching; historical thinking; teachers; students; ICT

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1. Introduction

Digital archives have become virtual historical laboratories easily accessible for historians and students [1,2]. Educationists have described this as a digital revolution and a democratic possibility for historians and history students to search, collect, critically examine and corroborate information from the past [3,4,5,6]. Scholars claim that Information and Communication Technology (ICT) makes it possible for students to experience, transform and manifest knowledge in a wide variety of forms [7,8]. They emphasize how digital archives containing primary sources make it possible for students to come closer to the people of the past and their everyday lives, stimulating historical empathy [3,6].

Lévesque highlights digital history for its "enormous potential of promoting and enhancing the active learning of history" [6]. In line with his claim, other scholars describe the use of digitized primary sources and historical archives in classrooms as a way to make students act and think more like historians [5,9]. Training students to think like historians – so-called "historical thinking" – is increasingly emphasized in history teaching, both in guidelines and research [10,11,12,13]. This perspective on history education highlights "sources well scrutinized" rather than "a story well told" [14]. To implement more historical thinking in classrooms there is a need for more activities involving primary sources [15]. This need is underscored both politically and in research on how historical studies and education can and should benefit from using more ICT [16,17,18]. By using digitized sources Lévesque claims that the students can walk in the footsteps of contemporary historians in their studies of the past [6].

However, what scholars describe as a digital revolution holds many challenges for history teaching [3]. Teachers might have limited access to projectors and computers, and even with the technical equipment easily accessible, the teachers might not use them actively [15,19,20]. If the teacher does not focus on training students' historical thinking, primary sources, even if digital, might just be used for "simply looking at pictures" [15]. Using digital archives made for historians might be difficult due to the lack of pedagogical design and teachers' digital knowledge [4,21]. Active learning also takes time, which is a conundrum for teachers given the limited timeframe they confront to target the comprehensive goals of history teaching. Last but not least, the authentic sense and smell of primary documents is lost in the digital records [22]. It is also important to note that previous positive results from the limited research on digital history in classrooms are primarily found in studies when students use websites constructed for education [5,6,23].

In this study we use instead an authentic digital demographic database of historical populations made for professional historians, which has thus not been used in school teaching. In history teaching that, according to the syllabus, should teach students to search and critically use historical sources we consider that digital databases can be used when teaching students to work and think like historians. We are the first ones to test and evaluate this database in history teaching focusing on the users' view, here represented by teachers but primarily students. Our purpose is to better understand both problems and possibilities of incorporating a large digital database designed for historians in the upper secondary classroom.

2. Theoretical Considerations

The theoretical starting point for this study lies in the scholarly assumption that digital history, and more specifically the access to large historical data and primary sources, can be used in a history teaching. According to this perspective digital archives can make history teaching a learning process more similar to the professional study of history, a process containing historical thinking [3,5,6,9]. However, we also acknowledge that digital technology in classrooms involves many challenges. Digital technology might not be easily incorporated into history teaching and does not automatically improve practice [3,4,15,21].

The practice of history teaching is very complex and the transformation of historical content knowledge into history education is far from simple [24]. Theoretically we understand history teaching as a matter of content knowledge, pedagogical knowledge and most importantly, pedagogical content knowledge (PCK) as a bridge between content knowledge and pedagogical knowledge [25]. A teacher of history lands in an area of knowledge within and between the subject of history and pedagogy. This field of knowledge that Lee Shulman identified as a "missing paradigm" [25] contains both historical content knowledge and pedagogical knowledge, but also most importantly knowledge beyond and in between the two, so called PCK. The concept of PCK contributes to the understanding of how subjects such as English, math, sports and history are clearly distinguishable as separate subjects and thereby different as subjects for learning, in practice. In this study we, therefore, consider both more general pedagogical issues in the incorporation of digitized historical data, as well as matters of historical content knowledge, and the skills of historical thinking. We perceive the use of the digital database in the study as a part of the technological content knowledge of today's historical research [26]. Technological content knowledge is presently a common part of many historians' skills and thinking, as common as searching for information at libraries and in archives. In history education the complexity of technological pedagogical content knowledge (TPCK) needs to be addressed and better understood [26]. Considering the perspectives of TPCK makes it possible to study the intricacy of history teaching in a digital age.

We understand historical thinking as the historians' "sense-making activities" [27] when studying the past and the experts' "ability to navigate the uneven landscape of history" [28]. Historical thinking helps the historian to formulate research questions, use historical evidence, contextualize the findings and make critical and empathetic conclusions [12]. The "unnatural act" of thinking like an historian was developed and studied when using primary sources such as pictorial and written evidence [27,28]. In this study we use this theory on students studying somewhat different types of sources, whether and how students are able to use large datasets in a scientific, disciplinary, way. The ability to formulate a hypothesis, search and analyze sources is central in this type of historical thinking. An important part of historical thinking is also the ability to contextualize the findings, often labeled historical empathy [29]. In this study we primarily focus on historical empathy as a cognitive act of perspective taking [30,31]. Historical empathy can also be considered as a matter of emotions and sympathy, so called historical empathy as caring [31]. We acknowledge that history can be quite emotional, but in this study we focus on historical empathy as an intellectual operation where contextualization makes it possible to understand how "the past is a foreign country" [32]. Since students enter into the history classroom with very different preconceptions and knowledge [33], it is important to learn more about

how different students experience working the same digital primary sources that historians use in their professional work.

Keeping the promises of the new technology in mind, we find it highly interesting to see whether students experience this digital database as a help in their studies of history and whether they are able to use historical thinking in their knowledge construction, when using a digital database designed for professional historians. How students perceive the new digital tools is of vital importance for their learning. Even if the tools (digital databases) are regarded as excellent they will not work very well if the students fail to understand them or perceive them as irrelevant.

3. Study Design

Our study is an exploration of the complex circumstances associated with history teaching, when this involves an experimental incorporation of a digital database, containing large historical demographic data. Using our experiences from school practice and professional use of digital databases, we have scaffolded the students' work with the digital database. The pilot study of 2001 and subsequent studies made in 2002 and 2011 were conducted during two weeks of teaching 19th century history, focusing on different (population) developments during Sweden's industrial revolution; a timeframe for the lesson unit that we consider realistic in practice. Our research on practice and the implementation of new media in historical studies is based upon a perspective where new technology should be "carefully introduced within the context of existing teaching" [3].

According to the national syllabuses history should promote students' knowledge of change based upon different interpretations and perspectives, focusing on epochs, events and/or people. Students' skills in formulating historical questions, searching for information and then scrutinizing, interpreting, concluding and presenting historical knowledge, are other abilities that should be trained. History should further promote students' historical consciousness and make them reflect upon connections between the past, the present and the future. The lesson units we planned were based upon these guidelines and emphasized history teaching as being based on active learning processes where students are to act and think like historians.

The pilot in 2001 and the following study in 2002 were conducted by Vikström [34]. Vikström was the teacher and a participating observer in all the three studies. The pilot study involved 28 students (age 16–17) in a science class while the follow-up study in 2002 had 17 students (age 18+), and the study in 2011 involved 17 social science students (age 16–17). All classes were studying the upper secondary basic history course. The classes were selected on the basis of their being available and willing to participate in the study. Critically discussing and using sources has been noted as an activity that becomes more evident in upper secondary school history teaching in Sweden, thus this teaching fits into "ordinary" school practice [35,36].

In 2001 and 2002, before searching the database, the teacher held lectures on historical developments during industrialization and the students read the textbook. The teaching was prepared with regard to the students' lack of experience in using digital archives. The teacher handed out an introductory text (word count 1802) to demonstrate the database to the class. Examples of manageable themes as well as cohorts were made in advance to assist the students in organizing their search in the database. The teacher proposed a few themes for them to explore: migration, family structure, single

mothers, disabled individuals, criminals and mortality. To help the students write down the information they collected, the teacher provided them with a worksheet.

In 2011, the two of us collaborated and developed the lesson unit in dialogue. Also in 2011, the general historical developments in the 19th century were studied before the lesson unit, but this time with a specific respect to illegitimacy. As a preparation for the lesson unit the students read a text on "Dangerous Women and Children" [37], which described the stigmatizing of illegitimate children and their mothers in 19th century Sweden. The lesson unit was limited to about an hour and a half of introduction of the database and another four hours of students working with the database, producing papers on 19th century Swedish history. Vikström acted as instructor of the digital database and assisted the students during their first laboratory, while Nygren conducted the preparatory lessons and supervised the students' individual work with the database. Because the students in 2001 and 2002 had described the entire lecture unit to be pretty hard to grasp (see results below), we decided to limit the lecture and assignment to illegitimate children in the 19th century. This time, we also made the handout considerably shorter (word count 390) (see Appendix1). The fact that illegitimate children are easily identified in the database and because students usually find those so-called 'bastards' and the historical treatment of them interesting and provocative, made us opt for this research topic instead of the multiple themes that the students were told to choose from in 2001 and 2002. Thus we simplified the instruction in 2011 by narrowing the topic to one theme, clarifying the instructions, and reducing the group size.

We do not claim that we repeated the exact lesson unit. Both our instructions and the technology matured by 2011, for instance all students had laptops. The student groups then were also somewhat different considering age and interest. But as the same (updated) instructor was using the same (updated) database and since the students were confronted with a comparable assignment, we argue that the comparative findings acknowledged below suffice to highlight similarities, differences and even change in the students' perceptions of using a digital database in history teaching; perceived problems and benefits in the incorporation of a professional's historical tool.

4. Data and Methodology

The professional tool we tested on the students contains unique digitized demographic data and consists of primary sources comprising Sweden's parish registers. They include information on people's life cycle and define their individual features, families and demographic experiences in the past. The registers we used are stored at the Demographic Data Base (DDB), Umeå University, Sweden, and are open for public use on Internet [38]. Since 1973, the DDB has computerized parish registers from 18th to 19th century Sweden to make them available for research both nationally and abroad. This database now includes 5 million parish records from about 1.2 million individuals [39]. It is the largest historical database in Europe, and one of the largest in the world. It is unique for its wealth of annual data per person regardless of whether he/she was rich or poor, old or a child, man or woman, migrant or native, ill or healthy, born out of wedlock or not. Thanks to a search engine developed by the DDB, 'Indiko', it is possible to find individuals, or define cohorts of interest, in the digitized database. Indiko shows a transcription of the original records (on birth, marriage, migration, death, and annual data from the catechetical examination lists) that are linked together for every

individual. However, the DDB has not established Indiko to provide teachers and students in schools with digitized data, but to extend the access and use of the parish registers among scholars, genealogists and university students. Scholars from different disciplines have thus extensively used the DDB's parish registers in their research, but these registers have not previously been in use or explored in research in history education.

Figure 1 shows an image of the search engine's interface. It confronts everyone making use of the Internet and Indiko to retrieve demographic data on the individuals from the DDB's database 'POPUM', which provides all the interlinked parish registers. By filling in the fields, or defining dates in them or by making selection from ready-made menus constructed by the DDB, the user can target the type of individuals he/she would like to study, for instance, by retrieving all illegitimate children born in one particular year, or within a specific time interval, and in different parishes. As a result, the search engine allows the user to construct comprehensive cohorts to analyze time-space differences in illegitimacy on aggregated levels. Even more interesting is that Indiko, in being based on the parish registers, makes it possible to have a closer look at every single individual of interest, in our case children born out of wedlock. This helps the user to picture who these 'bastards' were and how their life developed in case they survived their first critical period in life. If they grew up, the user will find what occupation illegitimate children took up as adults, whether and whom they married and if they gave birth out of wedlock themselves. This information is accessible in Indiko because the parish registers and the people they include are interlinked. Thus, Indiko shows the family and relatives to each individual in case his/her close kin were present in the same parish.

Figure 1. User interface of Indiko, the search engine developed by the Demographic Data Base (DDB) to make the digitized parish registers available online. The image shows the interface where users are to start their exploration.

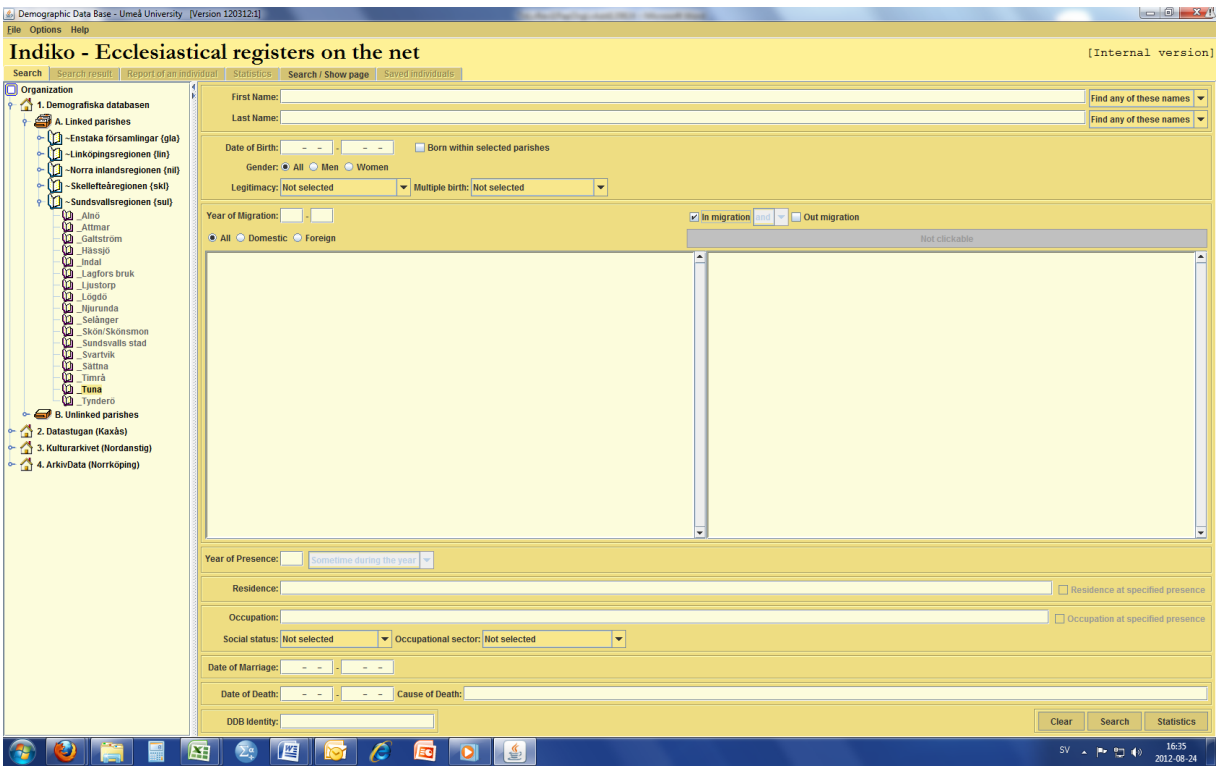
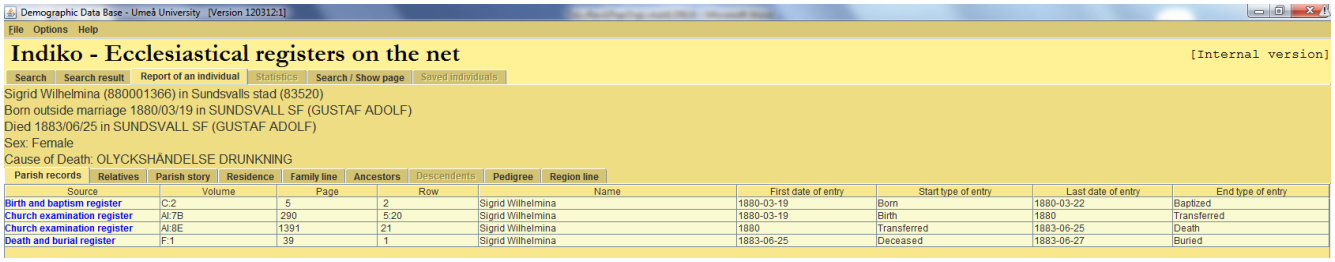


Figure 2. User interface of Indiko, the search engine developed by the Demographic Data Base (DDB). This image shows the outcome from having selected individuals born out of wedlock in 1880 in the urban parish of Sundsvall. From all the individuals Indiko then listed by name, one girl was selected to view more closely, Sigrid Wilhelmina. The image shows some basic demographic information on her and the different parish registers she is registered in. One 'click' on one of those registers will bring up the register and the person it concerns for users to find out more information, of which only a brief selection is evident on this image. For instance, that Sigrid Wilhelmina died accidently in 1883 by drowning is based on data in the death and burial registers.



The above outline (see Figure 2) exemplifies one means of how Indiko's search engine allows users to reconstruct individuals' life history even though this goes back more than 150 years. However, as this study will demonstrate, there is often a gap between what is possible to do and find out by using search engines online and what the actual outcome from using them looks like, in particular when the users are young students and the search engine gives access to historical sources that are far from complete or easily interpreted when viewed today or by laymen. As was discussed above, the DDB has not developed Indiko with this particular group of students in mind. Although the DDB offers guidelines to aid Indiko's usability, these are quite comprehensive [40].

The pilot study in 2001 was the first time that the DDB was used in upper secondary teaching and it was highly explorative. The students presented their results orally and answered a single question on how they experienced the use of the digital database in teaching. Their answers were then categorized as either negative, or positive or both/mixed. The following study in 2002 was also an early and quite explorative attempt, but it resulted in more detailed questionnaires and student papers that could be analyzed [34]. For comparative reasons we used the same questionnaire in the follow up study of 2011, but we also developed it to identify more student experiences [35]. To highlight their different experiences we categorize the students' responses as negative and positive below. Our categorization is based upon the students' perspectives in the questionnaires and how their comments are linked to the forced choices, scaled from very negative to very positive (see Appendix 2); for instance a student marking a negative choice and commenting that teaching was "messy", makes us categorize "messy" as negative. We further analyze and discuss their comments, as we have made room for them in the questionnaires. Our use of quotes is based upon our will to forefront the students perceptions. Being a limited study we cannot say what is typical in a more general sense. However, we can use the students own words to highlight different practice based perceptions. Aware of the difficulties of being a participating observer in case studies [41], we use our observations, noted in reflective field notes after the sessions, as a complement to the students' examination texts and answers to the questionnaires.

As for the 2011 study, we have also scrutinized the students' examination papers to understand whether and how the digital database can be used in students' knowledge production. Assigning the students to write individual papers is based upon the fact that this is a common practice in Swedish history teaching and we as historians are trained to both construct texts and analytically explore them. Given the optimistic perspectives in research on how digitized primary sources can stimulate learning, we looked for indications of historical thinking in the students' examination texts and in their answers to the questionnaires. In the light of previous research and theories of historical thinking (see theoretical considerations) and bearing in mind the task we had designed for them we considered it possible for students to: (1) formulate historical research question(s); (2) formulate a hypothesis; (3) use primary sources as historical evidence; (4) scrutinize and corroborate the sources; (5) corroborate the hypothesis; (6) contextualize the findings; and (7) use historical empathy. Our analysis of each individual text has been guided by the following questions: (1) Does the student formulate independent research question(s) in the texts? (2) Is there a hypothesis that is relevant to verify or reject from using the data? (3) Are empirical data used as evidence to answer the research questions? (4) Does the student discuss the accountability and limitations in the sources? (5) Does the student link the results to the hypothesis and discuss the results? (6) Are the results contextualized in the general historical developments? (7) Does the student make statements taking into consideration the fact that the people lived in a different physical and ideological context? In all, this analysis highlights what is possible–and what is not–to construe by 16-year olds in a lesson unit using a digital database designed for historians. This will help us understand if students are able to think and write like historians when studying historical demographic data.

In line with ethical recommendations, our study is based on informed consent and all participants are anonymous [42]. The students' statements in the questionnaires and papers are thus given anonymous codes. Capital letters are given below to signify the chronology of their statements and the year they participated: for instance, the first student quoted from 2002 is labeled 'A02'. Students' examination papers from 2011 are coded as text one to 14 (Tx1–Tx14). Some students have more than one quote.

5. Students' Perceptions of Using Digital Databases in History Teaching

Table 1 reports how students perceived digital history in 2001, 2002 and 2011. In the first pilot study (2001), students responded to an open question asking: "How did you experience using the digital database (Indiko) in teaching?" In the following studies (2002 and 2011) the students filled in a more detailed questionnaire that provided forced choices on a graded scale of four options (see Appendix 2).

Table 1. Students' responses to how they experience digital history in 2001, 2002 and 2011 according to the modified categories (2001) and the four-fold choice option (2002 and 2011)

How did you experience using the digital database (Indiko) in teaching?	--	-	- +	+	++	Total
2001 Absolute distribution (N)		10	6	4		20
2001 Relative distribution (%)		50	30	20		100
2002 Absolute distribution (N)	2	3		4	5	14
2002 Relative distribution (%)	14	21		29	36	100
2011 Absolute distribution (N)		1	2	12	1	16
2011 Relative distribution (%)		6	13	75	6	100

Sources: Evaluating questionnaires

Comments: In 2001 20 out of 28 participated in the evaluation, in 2001 14 out of 17 and in 2011 all students filled out the questionnaire. In 2011 one student was absent during most of the lesson unit and therefore did not answer this question. In 2011 two students claimed not to be able to decide between the forced choices, and therefore put their X in between the options of rather negative and rather positive. The scale from -- to ++ (from very negative to very positive) is based upon self-reported perceptions in questionnaires (see Appendix 2).

The findings of Table 1 show a change over time as regards how students perceived working with the digital database. Those of the pilot study (2001) were more negative than positive to Indiko and the entire lesson unit, as every second student did not like it at all (50%) and only one in four was slightly positive (20%). Even though the percentage of positive students had markedly increased in 2002, still 35% of them perceived the teaching in a mostly negative way. In 2011 only one student out of 17 was entirely negative. In all the three studies, the students demonstrate both negative and positive experiences from the use of digital history. What they describe as obstacles and benefits in using the digital database need closer examination. What did they, in their comments, perceive as negative and positive in using Indiko in history teaching?

6. Students' Perceived Problems

6.1. "Messy"

One recurrent complaint from the students was that the lesson unit was unclear, or "messy", to use their own words. In their comments "messy" primarily concerns (1) the instructions, (2) the digital tool and (3) the limited time. In 2001, for instance, one student argued that the lesson unit was "messy, complicated" and that "time was insufficient" (A01). Another student stated that "the instructions were not good and for the most part it was pretty messy" (B01). The work with Indiko was also depicted as "messy, the computers floundered as usual, but were good as variation" (C01). Even though the group of negative students had decreased in 2002, they too complained about the messiness. One student found working with Indiko as "stressful, messy and hard to interpret" (A02), whereas another one stated that the "time was too limited – I needed more teacher instructions to see connections. It was a bit chaotic" (B02). Interestingly, no complaints of messiness were raised among

the students in 2011, but the database was criticized for being slow and malfunctioning, which made it complicated to use. As one student put it, "the homepage was malfunctioning on several occasions" (A11).

Not all students using the term "messy" were entirely negative in their attitudes. Especially in the comments from 2002 the messiness did not ultimately detract from enjoyment. For instance how "[it was] a bit messy, but good and fun once you started to understand" (C02) and "it was a bit messy at first, but later it was made clear" (D02). These quotations exemplify the positive responses some of them experienced in spite of other perceptions of messiness.

6.2. "Meaningless" and "Incomprehensible"

The most negative comments were made by students experiencing the lesson unit as meaningless and/or very complicated. In particular, this held true for students in the pilot study (2001), who found the teaching to be "dull and meaningless" as one student put it (C01). Another student "didn't understand a thing" (D01), and a third one declared that "I still don't understand why we did it" (E01). There were many other students having a hard time understanding the point of using the digital database and studying the life of ordinary people in the small parish of Tuna. One student even argued: "Do the world a favor and forget about Tuna parish" (F01). In 2002 one student emphasized difficulties in understanding the teaching: "I thought it was incomprehensible at a high level" (E02).

6.3. Malfunctioning Computers and Database

A highly frustrating factor mentioned by students was malfunctioning computers and databases. In particular in 2001 and 2002, malfunctioning and slow computers complicated the teaching, as did some troubles with getting access to the Internet and thus Indiko and the digitized database. In 2011 the laptops and the access to Indiko were more carefully tested before the lesson unit started, but technical problems were still evident. The students' reactions were negative, criticizing the database for being complicated: "It could shut itself down and it was always lagging" (B11). Students also disliked the website's design – stating that it "was pretty ugly, and the color disgusts my eyes" (H11).

6.4. Complicated

Students in 2001 and 2002 with positive attitudes to the lesson unit as a whole also perceived the task as hard to grasp. To contextualize the piecewise information available in the database, for example, was thought to be particularly difficult for them. One student described the task as "messy, fun, but problems when we didn't get the 'big picture'" (G01), and another student perceived it as an "interesting task, but it was hard to grasp and make connections with the developments during industrialization within the limited time frame" (F02). "Well, it was a messy but important exercise, with high demands on the student" (G02). Also in the most positive group in 2011, two students claimed that they "did not always understand" the instructions, but still found the introductory lecture quite good (C11; D11). In this group there were no complaints about the task being too demanding or difficult. It was primarily the digital tool that the students in 2011 perceived as complicated.

In 2002 and in 2011, a vast majority of the students admitted that they would probably find it difficult to use the digital database without some sort of introduction and supervision from the teacher. This is evident in Table 2. Even though the percentage of students who claim that they would be able to explore Indiko without instructions increases between 2002 and 2011, from about 28% to 47%, there is an obvious need to provide them with some scaffolding.

Table 2. Students' perceptions of how they would have managed the digital database without instructions from the teacher in 2002 and 2011.

To what extent would you have been able to use Indiko without instructions?	--	-	+	++	Total
2002 Absolute distribution (N)	1	9	3	1	14
2002 Relative distribution (%)	7	64.5	21.5	7	100
2011 Absolute distribution (N)	4	5	6	2	17
2011 Relative distribution (%)	23.5	29.5	35	12	100

Sources: Evaluating questionnaires

Comment: The scale from -- to ++ (from very negative to very positive) is based upon self-reported perceptions in questionnaires (see Appendix 2).

Students' difficulties with understanding and navigating the database are evident in their responses to the questionnaires. They acknowledge a range of different problems that they confronted while working with Indiko. The fact that a single tick in the wrong box might "give you totally wrong results" (D11) made it complicated, according to one critical student in 2011. Another student, who did not attend the introductory lesson, stated that "I don't understand that page!!" (E11). Students who did attend it claimed that without the teacher's instructions "I would most probably have marked the wrong options and hated it" (B11) and that "it would have taken much longer" (F11) to find the correct information. Students further found it perplexing that not all information could be located in the database. The fact that some parish records for one town had been destroyed by fire were perceived as problematic and the fact that the records ended in the 1890s complicated their research. These source-related circumstances were perceived as complicating the research, as did the discovery that we cannot always trust the data – for instance one student thought it "a bit strange" that a child in the database was categorized as illegitimate even though the mother was married prior to the birth (G11).

6.5. Limited Time

Especially in 2001 and 2002, the students complained about the limited time they had at their disposal to explore the database. "Indiko wasn't much fun, you just don't get much out of it in such limited time" (K01). They further expressed how time pressure made it stressful for them to find information, analyze it and draw conclusions from their findings. That the students experienced the lesson unit as both messy and complicated was in a number of comments linked to the perception of time being too short to complete the task. The limited time-frame was also perceived as a problem when it hindered more positive students from learning more. According to one student in the most critical group, there was "too little time, we should have been allowed to search more freely" (L01). In

2002, a few students pointed out that more time, especially with teacher supervision, would make an already interesting task even more interesting.

In 2011, one of the highly positive students noted that in the first lesson "It was a bit difficult to get started with the task in such a short time, but it was exciting" (H11). However, in this student group the amount of time was not recognized as a major problem for their work. Several students claimed instead that without the support from instructions and supervision, their work would have taken much longer, but no students complained about the limited time for the lesson unit.

7. Students' Positive Reactions

7.1. "Unambiguous" Instructions

The above findings, primarily based on the students' responses in questionnaires, suggest that their perceptions of digital history are indeed diverse. We nevertheless can detect a general and positive change in their reactions during the period under study (2001, 2002 and 2011). We modified the instructions that were widely criticized among the students in 2001 and 2002. As mentioned previously we limited the assignment to one theme, made shorter written instructions and strived to be clearer in the oral instructions. In 2011 all students were positive to the introductory lesson: seven of the 15 participating students perceived it as good and eight as very good. In their comments, positive students described the lesson as "clear and unambiguous" (I11). In the positive responses in 2011 the teacher's instructions were described as thorough and by students who stated that it was easy to grasp the purpose of the task and get started using the database. Two students perceived instructions as good but complicated. One of them stated that "I did not understand everything, but it was good".

7.2. "Interesting" and Meaningful

In 2001, the students had a particularly hard time understanding the purpose of studying social history using digital databases. However, four students described the lesson unit in more positive words, finding it "interesting and instructive" (H01), "quite alright once you understood how it works" (I01) and thought "sitting in front of the computer is fun" (J01). In 2002, the students considered working with the database as "important", "fun" and "instructive" (F02; G02; E02).

In 2011, the students answered a question about how they perceived teaching based upon the digital database in comparison to other kinds of teaching. One student was negative to this type of digital history, eleven were positive to it, and five very positive. Some of the positive students underscored that there was "a genuine sense, as if you did your own research" (J11). Other positive students mentioned how working with the digital sources made them "get closer to the people" in the past (F11). It was "interesting since you know that it is from that era" (K11) and "You get closer to the events since those people have lived" (I11). Even if the students in 2011 were quite positive, they wanted varied history teaching, not just using digital history. A number of positive students still preferred other kinds of teaching, stating for instance, "I like lectures, it is my favorite way of learning" (L11) and "I prefer other sorts of teaching. This was fuzzy and insecure since it was so easy to fail the search and miscalculate" (H11).

After the lesson unit in 2011 a number of students emphasized how, in future, they will remember the historical situation for illegitimate children and their mothers – for instance, that "bastards" died much earlier than "legitimate children"(K11) and that "surviving was easier in the countryside" as compared to urban areas.

Two students thought it quite interesting that their hypothesis proved to be wrong. The situations for unmarried mothers were not as bad as one of them had expected – in fact, "many women gave birth out of wedlock and later got married anyway" (G11). The second student found that "the situation for the illegitimate children wasn't as hopeless as I thought after reading previous texts" (H11). A few of the students further discovered some intriguing details of how a "disease made people's throats very swollen" (I11) and how diarrhea was seriously life threatening in 19th century Sweden (D11).

8. Teachers' Observations

Basically, our observations confirm the students' perceptions of the lesson units. From a teacher perspective, the malfunctioning of computers and the lack of time that characterized the study of 2001 created considerable problems. Abbreviations of ministers' notes in the database also turned out to be difficult for the students to comprehend, even if some of the most frequent abbreviations were available and explained in a handout at the start of the pilot. In the teacher's reflections from this study a great deal of confusion and frustration was noted. Similar to the students, the teacher noted how the situation was messy with a stressful lack of time. The lesson plans that initially seemed well thought through turned out to be far from it, and the majority of the students showed little interest in the teaching [34].

In 2002, the computers worked better and the teacher had made the preparatory instructions and handout more sharp and limited. These students appeared to be more interested than those in the previous group. Even so, the time was, from a teacher perspective, far too limited. What was supposed to take one hour took two. Many questions needed answers, partly because the students did not understand the database, partly because they had difficulties with understanding the task as a whole. The more developed handout was not read and/or understood by many of the students who therefore needed extra supervision.

In 2011, the two of us were collaborating as teachers; one (Vikström) was responsible for instructing the students about how to work in practice with the digitized data; the other (Nygren), responsible for the subsequent lessons and examination task. The instructing teacher, Vikström, perceived the time-frame as too limited for completing the introductory lecture. Again, there were time-consuming questions from the students that needed to be answered, but yet the lesson plan was implemented. The students appeared to be interested and their activity level was high during the preparatory lesson.

The following lesson, which was run by Nygren, was also characterized by high intensity and interest among the students, but also by frustration as they still did not entirely understand the database and because the teacher, in being less familiar with the digitized data than the instructing teacher failed to answer their questions satisfactorily. The questions concerned how they were to use the database, what is a 'good' research question (hypothesis) and how to construct a table? At this particular lesson two students had forgotten their laptops. Instead they had to use computers in a separate classroom

four floors away from the rest of the group, making the teacher run up and down the stairs. The teacher observed intense work with the task, but two students claimed to have completed it after having verified their hypothesis in only a few words.

In the third lesson only four out of 16 students were able to log in to the database. When the login did not work, students expressed anger and resentment towards the database. As a result, some students turned their interest to Facebook. Also students claiming to have finished the task opened up Facebook. The few students that were able to log in helped other students, but the malfunctioning website disturbed the teaching. One student, using someone else's computer, had a hard time finding the individual that she had found during the previous lesson. Some students simply gave up and said that they would finish their work at home, hopefully with a database that would let them log in. Two students not present during the first two lessons were given a lot of attention from the teacher, who explained the task, gave them a hypothesis and made sure that they could find some sort of results to analyze.

In the verbal evaluations that followed the lesson unit and in the presentations of their results in small groups, the students expressed how they found the work with the database rewarding in many ways. They made positive statements about how the task had allowed them to do real research, but they also criticized the database for its limitations and technical problems.

9. Results from Analyzing Students' Texts

In 2002, 15 out of 17 managed to complete the task within the time-frame. One student late in completion was graded, and one student failed. The grading was on a three level scale: four students passed (G), nine were good (VG) and three were deemed excellent (MVG). A majority of the students' texts were considered to contain critical thinking and some contextualization. Some students questioned the myth of how people were supposed to live in the three generation families. Other students found that single mothers could get married, proving them not to be as stigmatized as they have been described in literature. A number of students showed great empathy with the people in the past, sometimes adding a lot of personal beliefs and turning history into storytelling.

In 2011 all (17) but two texts (late due to illness) were completed on time. Grades from F (fail) to A (excellent) were given. Scrutinizing and categorizing the students' papers on the basis of theories of historical thinking, a variety of qualities can be found in the texts (see Table 3).

Table 3. Indications of qualities of historical thinking in students' texts 2011.

	Tx1	Tx2	Tx3	Tx3	Tx4	Tx5	Tx6	Tx7	Tx8	Tx9	Tx10	Tx11	Tx12	Tx13	Tx14	N(15)	%
Formulate research question(s)	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1	12	80
Formulate hypothesis	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15	100
Evidence	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	14	93
Sources scrutinized and corroborated	0	1	1	1	0	0	1	1	0	1	0	0	0	1	0	7	47
Corroboration of hypothesis	1	0	0	0	1	1	1	1	1	1	0	1	1	0	0	9	60
Contextualization	1	1	0	0	0	0	1	1	1	1	0	1	0	1	0	8	53
Historical empathy	1	1	0	0	0	0	1	1	1	1	0	1	0	0	0	7	47

Sources: Student papers 2011.

Comments: Paper 3 (Tx3) was coauthored. After missing the two initial lessons the two students writing Tx3 were told to cooperate to be able to manage the task in an even more limited time-frame than that of the rest of the students.

We found that most students were able to formulate research questions. Independent formulations inspired by research questions in the handout can be discerned in 12 of the 15 texts. For instance, comparing the city of Sundsvall and the small village of Galtström in order to further study the "mothers of illegitimate children in the 1890s", a student formulated the following research questions: "Who were the mothers of the illegitimate children? Did the women ever get married, and if so, to whom? How big could the age difference be?" (Tx1). Another paper studied the situation of illegitimate children during industrialization with the research questions: "Did the proportion of illegitimate children in the Sundsvall region increase between 1780 and 1850? Did infant mortality increase during industrialization and was there any difference in infant mortality between legitimate and illegitimate children?" (Tx2).

Three students did not formulate independent research questions. Two students were told to use existing research questions because they missed the two first lessons (Tx3). One student studying the marriage pattern for illegitimate children and their mothers did not formulate any research questions; instead the student just described what the study was about under the headlined purpose (Tx4).

In all the papers students formulated hypotheses for their studies (see Table 3), primarily expecting the situation for illegitimate children and their mothers to be very harsh. The digitized data were used as statistical evidence for their claims in all but one paper. Although the quality of the use of historical evidence varies, all but one used primary historical primary data to, more or less, answer their research questions. In seven papers (Tx1, 4, 6, 8, 10, 11, 12) students used evidence, but failed or were very limited in their scrutiny and corroboration of the sources and would have benefitted from a more thorough use of the evidence. In these seven papers the students used evidence, but were very limited in their presentations and use of their relevant data. For instance, students could fail to communicate in their text what they described in tables; they could lack precision in numbers and dates and also miscalculate. Working with digitized primary sources is certainly a challenge to many students. One student failed to notice how the digitized data ends in the early 1890s and therefore failed in the conclusions (Tx5). Another student produced a text with many qualities indicating historical thinking, for instance how the data is limited and construed by a priest "with his perspective on legitimate and

illegitimate children" (Tx6). This student still failed to see the limitations of the digitized data and therefore made some claims that lacked evidence.

Nine of the students utilized their data for analyzing their research questions and hypotheses in a more thorough way, verifying or falsifying their hypotheses (see Table 3). As one student put it:

> My results differ from the terrible image of death, poverty and exclusion that contemporary literature has painted. The results differ also to a great extent from my hypothesis. I have found that women's illegitimate children did not exclude them from the marriage market. A larger proportion of the women with illegitimate children that I studied married than those who did not [have illegitimate children], and they did not marry poor (Tx7).

Five of the nine students who corroborated their hypotheses discovered that their assumptions did not clearly fit the evidence, and were open for a new perspective on the past. They critically discussed previous research vis-à-vis their findings. One student discovering falsifying data tried to fit the evidence instead into the hypothesis using ad hoc theories to support previous research rather than criticizing historians and their claims. Three students found what they perceived to be valid proof of their hypotheses. Even if all students formulated hypotheses, six out of the 15 students did not link their results to their hypotheses, at least not in writing.

Contextualization of the results can be found in eight papers – for instance, describing how the newly industrialized city was an unhealthy environment for children "with diseases because it was so crowded and dirty" (Tx8). In the papers with contextualization, the results were associated to the historical period of industrialization, describing the situation in the city and/or countryside. The students addressed changes in physical and social living conditions. However, in seven of the papers contextualizing was absent.

Six of the papers which contextualized the results also included statements showing historical empathy. Why illegitimate children in the city had a higher mortality rate was, for instance, partly explained by the social situation at the time:

> As a woman, without the security that the family previously represented in the countryside, it was probably very difficult to supply one or more children on the meager salary of women (if they even got a job). The death of the illegitimate children would in such cases be caused by malnutrition and disease (Tx2).

Another student emphasized how the harsh living conditions for stigmatized women makes "you really understand if the mother killed her child or herself, considering all the pain that they had to endure", asking rhetorically, "who could bear something like that?"(Tx9).

10. Concluding Discussion

The major purpose of this study was to outline both the problems and possibilities associated with incorporating an extended digital database, primarily designed for historians doing research. Based on the students' experiences we find that even if young people of today have become used to computers and digital information, using a digital database aimed for professional historians is still a challenge to most of them. On the one hand, problems appear when the digital database is malfunctioning or is too complicated to comprehend or use. Hence students might direct their attention towards social media

instead of the task. On the other hand, the results suggest that exploring a digital database provide a possibility for students to construct relevant hypotheses, corroborate findings and contextualize them, which is the key to historical understanding. Below, we discuss this twofold outcome of our analysis, lessons we have learned from it and reflect upon some theoretical implications of the findings.

10.1 Perceptions and Instruction

Using a database with large historical demographic data in teaching, as in this study, is experienced as messy, frustrating and incomprehensible, but also as interesting and meaningful. Students have a hard time understanding and using primary sources, even if digitized, but the digitalization helps students access the sources that historians employ and give a sense of doing "historical research". Even if our groups differed in size and interest, the results underline how students wish for the teacher to clearly present the digitized data and the task. The results from this study inform us how reflections from previous practice, comprehensible instructions and a more limited task help to make the use of the digitized primary data a positive experience for students. Thus, using a digital source or tool does not take away from the teacher the importance of a careful planning of the students' work

10.2 Technological Issues

Frustration may be a good thing when it challenges students' historical thinking, but frustration is also evident when malfunctioning computers and websites obstruct the process of studying history. The classroom of 2011 with laptops and updated websites still contains technological challenges. History teaching with digital databases demands working technology, which we have seen is not always the case. In schools today time is limited so this drawback needs to be handled by schools, but also teachers should be prepared to direct students to parts of their work that they can proceed with even if they cannot use the database. This insecurity requires attention in an era of very positive perspectives on ICT. If teachers need to do double planning, digitalization will increase not reduce their workload.

That technical problems have a direct negative effect on the students' attitudes has become apparent in this study. Their excitement of using computers (even if they did malfunction) that was observed in 2001 and 2002 was not evident in 2011. In present-day classroom students not able to work on their study might very well turn their attention to Facebook. Social media constitute a problematic ICT distraction, also for some students of our study. Primarily, this was due to malfunctioning technology, which is clearly a time-consuming hindrance and, considering the limited time for teaching, works as a stress factor for teachers and students alike.

It is further evident that students involved in our study also called for more analogue teaching strategies. With reference to their learning style students might be positive to digital history, but still favor lectures, for instance. The students' responses indicate that they want more than computer-based teaching, even if they reacted positively to this lesson unit.

10.3 From Meaningless to Meaningful

The study reveals how students get lost in complicated tasks and have a hard time understanding the purpose of using a digital database. Particularly connecting the data of ordinary people to the more general historical developments was a problem for almost half of the students. Some students simply found this kind of demographic social history meaningless. However, it is also evident that students can find the task meaningful, especially in smaller groups with better planned lesson units. Especially the students in the 2011 study thought the task meaningful and interesting. About half of the students expressed historical empathy with ordinary people in the past. Students' stating that they come closer to the people of the past and contextualizing their results, we interpret as an act of historical thinking [12].

The use of 'bastards' as an entry point seemed to provoke interest. In a way this can make the past a foreign country where the students themselves, if born out of wedlock, might have faced a very different circumstances. Intriguing details and fascinating facts should not be underestimated in history teaching. The very detailed primary sources serve students' interest in life and death, blood and guts, in a realistic past. Making history meaningful and fascinating is a challenge of history teaching; digital history clearly has the potential to do this.

10.4 Walking in the Footsteps of the Historian

The fact that the students were able to validate or falsify their own historical hypotheses in a classroom is a very important result from this study. It highlights how digital history contributes to students' acting and thinking like historians. As professional historians do when they study the past, the students made use of statistical evidence from primary sources and looked into the individuals beyond the numbers to learn more about the illegitimate children and their mothers. Albeit not being satisfactory user-friendly, this digital database has facilitated the students' use of historical data to understand and question preconceptions of the past. In this way digital history teaching can promote historical understanding [43]. Our study shows students beginning to walk in the footsteps of the digitally competent historian: sourcing, corroborating and contextualizing primary sources [6]. Some students' experiences of historical data being complicated we partly interpret as a good thing. Their sense of achieving "fuzzy and insecure" results is in fact a step towards a deeper level of historical understanding. This involves not least to stimulate students' understanding of how historical material is incomplete and to make them aware of how they themselves influence and construe the results [3].

10.5 Transforming the Classroom

Our study suggests one means of how the professional historian's sources and tools can be brought to the classroom and used by students. However, most importantly, we demonstrate and discuss both the advantages and disadvantages inherent with digital history teaching as we perceive it here. It has become evident, that the digital database cannot substitute the teacher and other history teaching. Only one student claimed that there would be no problem using the database without scaffolding. Students' experience of the task being complicated clearly indicates that they want and need support from teachers. With scaffolding, however, the classroom might be transformed into a history lab where

technological content knowledge from historical research redefines teaching and learning [26]. The study shows how students in a limited time can formulate and test a hypothesis on an extensive actual historical material. Records of more than a million individuals can today be studied in an ordinary classroom, by students acting and thinking as historians. Although the results from this study reveal the complexity associated with the digital transformation of the classroom, it highlights how a digital database is possible to use to redefine history teaching in ways previously unthinkable where active learning gives students a sense of doing historical research themselves.

The students' papers indicate that digital history has a potential in making it possible for students to use their historical thinking. However it is also evident that not all students managed to produce qualified historical accounts. Making all students use historical evidence, contextualize and use historical empathy, evidently, takes more than a lesson unit with a digital database. We see the teacher as vital for helping the students understand how to use the databases, but also more importantly, for making the students understand the meaning of this type of history teaching. If the task is incomprehensible, it will appear as meaningless in the eyes of the student.

The complexity of teaching history using digitized data clearly calls for teachers with technological pedagogical content knowledge TPCK [26]. In this case the technology is evidently linked to the content knowledge of history and perhaps this fact – that technology is a servant of history – helps the students to think more like historians than much other technology is able to do. When the digital database technology works accordingly and the task is specialized and sufficiently guided by the teacher, our results propose that young people can think historically and act as experts. What scaffolding students need, in the media and by teachers, has to be studied further and more in detail [44, 45]. Studies scrutinizing for instance: the influence of different databases' web-design, how teachers with different technological, pedagogical and content knowledge scaffold students and how students pre-test knowledge and technical skills influence their knowledge construction.

With careful studies (considering both benefits and pitfalls) of digital databases in history teaching, the classroom can become a creative history lab. This digital history lab enables students to conduct experiments previously unimaginable in schools. However, future research and teachers' reflections from practice need to ensure that the lab does not poison education, and make students stumble and fall in the footsteps of the historian.

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Conflict of Interest

The authors declare no conflict of interest

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Appendix 1. *Written instructions from the lesson unit in 2011*

The era following the enlightenment and the French revolution is often called the modern era. The 19th century is in many ways the foundation of our contemporary history. A more modern society is evolving with "new" political ideologies, increased industrialization and changing social conditions. Political, economic and social changes during the 19th century, clearly influenced life and society in Sweden.

Your task is to investigate how Sweden changed and what the changes meant for some ordinary people in the 19th century. Using the digital database INDIKO you should examine the history of common people (so called micro-history). You should formulate questions to the digitized church books to study life in Sweden in the 19th century.

Based on the introductory lecture you are supposed to examine the history of illegitimate children.

For example, you can examine:

a) If the number of legitimate/illegitimate children increases over time in line with the industrialization of Sundsvall city.
b) If differences in the number of illegitimate/illegitimate children differ between an industrialized environment (Sundsvall City) and an agrarian environment (e.g. Skellefteå or agricultural parish in the Sundsvall region)
c) Who were the mothers of these children (age, occupation, geographical background)? Did they give birth to several illegitimate children; did the mother find a man to marry who wanted them despite the illegitimate kid? Who was he in that case (older/younger, employment, widower?)
d) What happened in the life of the illegitimate child (did he/she die young; have a light/dark future?)

Goal

You should individually formulate purpose and research questions, investigate your topic, present your results, discuss your results and draw conclusions based upon the discussion. Your paper should be presented in writing and orally at the seminar. The text should be sent in Word format to xxx@xxx.se

The text may include a maximum of 5 pages, size 12, 1.5 line spacing, font Times New Roman or similar.

Formal disposition of paper

1. INTRODUCTION. A short introduction of the subject and what makes it interesting to study.
2. PURPOSE. The purpose of the study and research questions should be given and later answered in the paper.
3. METODOLOGY. A discussion of your sources and methodological considerations.
4. RESULTS. Here the answers from the sources should be presented.
5. CONCLUDING DISCUSSION. Answer to research questions, evaluation of material and individual conclusion.
6. LIST OF SOURCES AND REFERENCES.

Readings: ”Perspektiv på historien” pp. 163-244, especially pp. 212-229.
Ann-Sofie Ohlander ”Farliga kvinnor och barn – Historien om det utomäktenskapliga” in UR, Kvinnohistoria

Appendix 2. *Student questionnaires*

Evaluation question 2001

How did you experience using the digital database (Indiko) in teaching?

Evaluation questions in 2002 and 2011

How did you experience using the digital database (Indiko) in teaching?
very negative____ rather negative____ rather positive____ very positive____
Comments:

To what extent would you have been able to use Indiko without instructions?
very poorly _____ rather poorly_____ rather well_____ very well_____

Comments:

Have you missed something in the layout of the website Indiko?

Do you think that you in the will use Indiko or parish registers in genealogic research or future studies? Why? Why not?

What knowledge from the teaching do you think you will remember in the future?

Added questions in 2011

How did you experience the initial instructions and use of the database Indiko?

very negative____ rather negative____ rather positive____ very positive____
did not participate ____

Comments:

How did you experience history teaching with databases in comparison to other methods of history teaching such as lectures, reading texts/textbook, film, discussions, etcetera?

very negative____ rather negative____ rather positive____ very positive____

Comments:

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